IMPLEMENTATION OF THE POLYA PROBLEM SOLVING APPROACH IN MATHEMATICS LEARNING THROUGH GROUP INVESTIGATION STRATEGY BASED ON STRATEGIC COMPETENCE FOR GRADE VII OF SMP N 1 SURAKARTA

PUBLICATION ARTICLE

Submitted as a Partial Fulfillment of the Requirements
for Getting Bachelor Degree of Education
In Mathematics Department

by

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2013

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ABSTRACT

This research paper aims to analyze (1) the difference effect between Polya problem solving approach through Group Investigation strategy and conventional learning approach to student's mathematics achievement on the set material, (2) the difference effect of high, medium, and low strategic competence to student's mathematics achievement on the set material, (3) the interaction between learning approaches and student's strategic competence to student's mathematics achievement on the set material. The population in this research is all of students in grade VII of SMP N 1 Surakarta consist of 8 classes. The research sample was taken two classes, i.e. grade VIIF consist of 24 students as experiment class using Polya problem solving approach through Group Investigation strategy and grade VIIE consist of 24 students as control class using conventional learning approach. The sampling technique use in this research is cluster random sampling. Type of research is experimental research with methods of collecting data using test, questionnaire, and documentation. Data analysis technique uses variance two-ways with unequal cell, a prerequisite using normality test and homogeneity test. The result of hypothesis testing using a significance level of 5% satisfied that: (1) there is no difference effect of learning approach to student's mathematics achievement on the set material with $F_A = 0,045$, (2) there is difference effect of student's strategic competence to student's mathematics achievement on the set material with $F_B = 5,671$, (3) there is no interaction between learning approaches and student's strategic competence to student's mathematics achievement on the set material with $F_{AB} = 0,288$.

Keywords: Polya Problem Solving, Conventional, Strategic Competence, Set

Introduction

Mathematics is one of the science that demands critical thinking, logical, and systematic, as well as concerning the problems that require resolution of comprehensively and correctly. Mathematics has been introduced to us since childhood, started from know n numbers, how to count, until operate the complex numbers. Students dislike mathematics because this subject is very difficult to understand, so many students who are unable to solve the problem in mathematics.

Students less knows about problem which is carried out, so they difficult to solve its problems. Students didn't read the question carefully, they are not realizing what is known and what is asked and too quick start calculations. Students are not planning the solving way, they are not starting with what was asked and they are not connecting the general theory with problem worked. Students do not solve the problem in detail and students do not examine again the truth of his calculations. Therefore, student's factor about that difficulty needs to be eliminated by having the mathematical proficiency. One of the mathematical proficiency that needs to be developed is a strategic competence. Strategic competence refers to the ability to formulate, present, and solve mathematics problems (Djamilah, 2011: 3).

In addition, student's difficulty in mathematics learning is caused on the fault of teachers in selecting learning approaches. The various learning approaches can reduce the satiation of students and can increase the ability of students in learning mathematics. The approach of learning mathematics which usually be applied by teacher is conventional learning approach. Teacher delivers material to students without knowing the extent of ability obtained by students. The teacher is very dominating in the learning process so that most students were bored. The students do not have the opportunity to find their own answers so that students have not been able to understand the concept of the material are being studied.

Therefore, the need for a renewal of mathematics learning approach that student feel was more interested and motivated in the following mathematical

learning. *Polya* problem solving approach through learning *Group Investigation* strategy is one of the various approach of learning that can be applied in learning mathematics. One way to teach students to problem solve is to teach the fourth step processes developed by Polya: 1) understand the problem, 2) devise a plan, 3) carry out the plan, and 4) look back (Kousar Perveen, 2010:9). While in strategy of *Group Investigation* (GI), there are three main concepts, namely: research or *inquiry, knowledge*, and *the dynamic of the learning group* (Udin S. Winaputra, 2001:75). Thus, through the learning strategy of *Group Investigation* (GI) that completing with systematic steps in *Polya* problem solving, students can exchange ideas in order to solve problems such as making it easier for students to take the appropriate steps to get the most appropriate solution.

Based on explanation above, the objectives to be achieved from this study to analyze (1) differences effect between *Polya* problem solving approach through *Group Investigation* strategy and conventional learning to student's mathematics achievement, (2) differences effect between strategic competence proficiency are divided into three groups: low, medium, and high to student's mathematics achievement, (3) the interaction between learning approaches and student's strategic competence (high, medium, low) to students' mathematics achievement. So, the hypothesis can be formulated as follows:

H_{1A} : There is difference effect between *Polya* problem solving approach through *Group Investigation* strategy and conventional learning to student's mathematics achievement.

H_{1B} : There is difference effect student's strategic competence proficiency are divided into three groups: low, medium, and high to student's mathematics achievement.

H_{1AB} : There is interaction between the use of learning approaches and student's strategic competence proficiency to student's mathematics achievement.

Research Method

This research was carried out in Grade VII Junior High School1 Surakartain the even semester, 2012/2013academic year. The type of this research is experimental research. This research will look at the effect of the problem solving approach of *Polya* through *Group Investigation* strategy on student'smathematics achievement based on strategic competence that have students. The population in this research is all of students in grade VII that contains 8 classes. The sample of this research using two classes, VIIF as experimental class for *Polya* problem solving approach through *Group Investigation* strategy while VIIE as the control class for conventional approach.

Samples are taken with the technique of *cluster random sampling*. According to Budiyono (2003: 37) *cluster random sampling* is random sampling which is subject to row of units or sub-sub populations. Before each class is given treatment, both classes must be implemented tests of balance. Balance test aims to determine the balance condition of initial ability students. To compare the experiment class and control class, researcher used t-test sample.

The methods used to collecting data in this research are test method, questionnaire method, and documentation method. Before it is usedto retrievethe research data, research instrument in the form of questions to mathematics learning achievement tests and questionnaires of strategic competence have students tested first to see its feasibility. Testing is used to check the questions are validity and reliability test.To calculate the validity of instrument items, use the formula of *the product moment correlation* from *Karl Pearson* and to calculate the reliability index of essay tests used *Alpha Cronbach* formula.

The technique of data analysis used analysis of variance two ways with unequal cell. Before doing analysis of variance, prerequisite test analysis must be done, consists ofnormalitytest uses Liliefors and homogeneity tests uses Bartlett.

The Result of Research and Discussion

Before the sample is given treatment, researcher does the balance test to determine whether experiment and control class are balance. The data source of the balance test is taken from the final score mathematics in odd semester. From the result of calculation using ? test is obtained ?₍???₎ ? ??.??? and ?₍???.???₎ ? ??.???. Because ?₍???₎ ? ?₍?????₎ then ?₍?₎ is accepted So, experiment class and control class in the state of balance or they have the same ability.

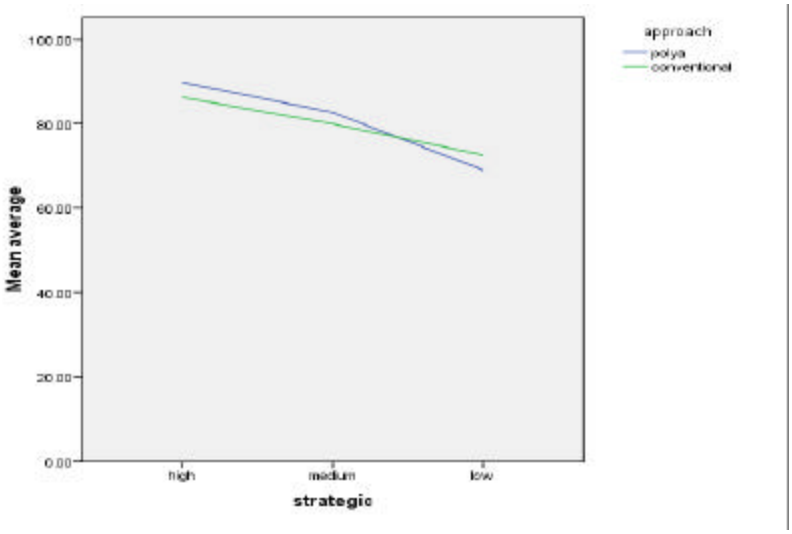
Instrument in this research include achievement essay test on the set material and questionnaire of student's strategic competence. There are 7 items for essay test and 30 items for questionnaire test. The score of each item is compared to the value of coefficient table at N = 26 and at 5% of level significance. From seven items that given there are not item that invalid, can be seen from the value ?₍??₎ ? ?₍?????₎. So, all of item are used to collect data in this research. From the result of calculation obtained ?₍??₎ ? ??.??? ? ??.??. So, achievement test try out for essay items on set material are reliable.

From the validity test of 30 items student's strategic competence questionnaire, 19 items are valid and 11 items are invalid. So, 19 valid items can be seen from the value ?₍??₎ ? ?₍?????₎ are used to collect data of strategic competence proficiency. Of the 19 items, after calculating the alpha formula, obtained ?₍??₎ ? ??.?? ? ??.??. So, student's strategic competence test questionnaires are reliable.

After doing treatment between experiment and control class, is obtained the average experiment class is 82,17 and control class is 79,46. Based on thedata that has been collected, for experiment class there are 6 students including high category, 14students including medium category, and 4 students including low category. While for controls class there are 4 students including high category, 15 students including medium category, and 5 students including low category. The graph of the average mathematics achievement outcomes as follows:

Figure 1

The Average of Student's Mathematics Achievement in Experiment and Control Class Based on Strategic Competence



With the fulfillment the properties of normality and homogeneity, that is normality test uses Liliefors method at significant level 5% is obtained $L_{max} < L_{table}$. It means that the sample come from population in normal distribution. From homogeneity test uses Bartlett method at significant level 5% between experiment class and control class obtained the value test statistics? $^{?}_{???}$? ? $^{?}_{?????}$. It means that the independent variables come from the same population or homogeneous. After the normality and homogeneity test fulfilled then analysis of variance two ways with unequal cell can be done. The results of the analysis of variancetwo ways with unequal cell are presented in the following table:

Table 1

Summary of analysis of variancetwo ways with unequal cell

Source	SS	df	MS	F_{obs}	F_{table}	Decision
Approach (A)	7,202	1	7,202	0,045	4,072	H_{0A} is accepted
Strategic Competence (B)	1802,55	2	901,274	5,671	3,222	H_{0B} is rejected
Interaction (AB)	91,69	2	45,844	0,288	3,222	H_{0AB} is accepted
Error	6674,92	42	158,927	-	-	-
Total	8576,36	47	-	-	-	-

Based on the summary of analysis of variance two ways with unequal cell with 5% of significant level are presented in the table above, shows that:

1. In the main effects row (A)

   From the analysis of variance two ways with unequal cell obtained in the table ?? ? ??? ? ??? ? ?? so H_{0A} is accepted. It means there is no difference effect between learning using *Polya* problem solving approach through *Group Investigation* strategy and learning using the conventional approach to student's mathematics achievement on the set material. The most of students of SMP N 1 Surakarta if given any learning approach does not affect their academic achievement because of the input of the school is already filter out students who have high intelligence. Some students are solving the problem using *Polya* steps, but there are part of students isn't applying *Polya* steps. So that, score of students isn't applying *Polya* steps are decrease.Students who solve the set problems using *Polya* steps can really understand what is meant in the question, can devise a plan to help solve the problem of designing, such as diagrams, tables, correlation information between known and asked, formulas that can be used and as a guide in resolving the problem, then they are implementing the plan in mathematical expressions to resolve the problem, and students are required to re-check with the way substituting those results into original problem that the truth can be known. While students who isn't solve the set problems using *Polya* steps not able to understand the given problem, may not present a problem mathematically, do not understand how to choose the right formula to solve the problem, and often do not check there turn results that have been obtained. In addition, the frequency of researcher in conducting the treatment *Polya* problem solving approach through *Group Investigation* strategy in experiment class is limited. This condition causes no difference effect of the use of *Polya* problem solving approach through *Group Investigation* strategy to student's mathematics achievement in SMP Negeri 1 Surakarta.

2. In themain effects column (B)

From theanalysis of variance two ways with unequal cell obtained in the table $?_{?}$? ??.??? ? ??.??? ? $?_{?.???.??}$, so H_{0B} is rejected. It means that there are differences effect in student's mathematics achievement that have high, medium, and low strategic competence on sets material. It can be concluded that the strategic competence of mathematics influence on student's mathematics achievement. The next step is doing multiple comparisons to know which one of the level of student's strategic competence have significantly different average to student's mathematics achievement. The result of multiple comparisons tests, students with high strategic competence proficiency will have mathematics achievement better than students with low strategic competence and students with medium strategic competence will have learning achievement better than students with low strategic competence.

Strategic competence refers to the ability to formulate, present, and solve mathematics problems.In line with the study is implemented by Nurlina Wijaya Kusumawati (2012) concluded that student mathematics proficiency is increasing through problem-solving approach. Student mathematics proficiency in presenting mathematical concepts in variety of systematic representation, use the procedure and choosing the right formula in problems solving are on the increase.According to Kilpatrick (2001) , one of the mathematical proficiency that having a student to successful mathematics learning that needs to be developed is a strategic competence. Strategic competence can support success of the learning process. It can be concluded that the strategic competence affect on the student's mathematics achievement.

3. In themain effects interaction (AB)

From the analysis of variance two ways with unequal cell obtained $?_{??}$? ??.??? ? ??.??? ? $?_{?.???.???}$ so H_{0AB} is accepted. It means that there is no interaction between learning approaches and student's strategic competence to student's mathematics achievement on the setmaterial. This

condition implies that the difference of student's mathematics achievement of each learning approach gives the same affect for each category of strategic competence and the difference of student's mathematics achievement of each category of strategic competence is consistent at each learning approach. The lack ofinteraction between learning approaches to strategic competence can also be caused by the influence of othe rvariables that are not controlled by the researcher, for example, student learning activities, level of intelligence, and the ability to beginning students, student discipline, student interest, and so forth.

Conclusion

Based on the theory and supported the analysisof data with 5% of significant level can be summarized asfollows:

1. There is nodifferences instudent's mathematics achievement significantly between who are given learning *Polya* problem solving approach through *Group Investigation* strategy and learning using the conventional approach on the set material, because the result of analysis of variance is obtained ?? ? ??.
2. There are differences in mathematics achievement are significant based on strategic competence of mathematics on the set material, because the result of analysis of variance is obtained ?? ? ??. Student's mathematics achievement with high strategic competence is better than students with low strategic competence.
3. There is no interaction between learning approaches and strategic competence to student's mathematics achievement on the set material, because the result of analysis of variance is obtained ??? ? ??.

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